

# PATENT SPECIFICATION

## DRAWINGS ATTACHED

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### COMPLETE SPECIFICATION

#### Improvements in or relating to the Fluid Transfer of Solid Particles

We, THE GAS COUNCIL, a British Body Corporate, of 1, Grosvenor Place, London, S.W.1, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention is for improvements in or relating to methods and apparatus for the fluid transfer of solid particles.

Many ways of controlling the rate of flow of solid particles have been developed but most of them involve the use of complicated apparatus having moving parts which tend to break down the solid particles.

According to the present invention there is provided a method for the controlled fluid transfer of solid particles which method comprises passing fluid upwardly through a mass of the solid particles to form the particles into a fluidised bed and providing additional flow of fluid to the upper part of the bed to transfer particles from the bed in an upward direction at a controlled rate.

The additional flow of fluid may enter the fluidised bed at a fixed height in the bed and the flow is such that with the flow of fluid employed for fluidising the solid particles it transfers solid particles from the upper part of the fluidised bed.

The fluid transfer of particles from the bed may be controlled by the rate of flow of the fluid which brings about the initial fluidisation of the particles.

Preferably the fluid is a gas, or mixture of gases, e.g., air.

The invention includes apparatus for the controlled fluid transfer of solid particles which comprises a container having a fluid-permeable support for the particles, the upper part of said container terminating in a con-

duit, means for passing solid particles into the container so that the particles are introduced into the container above the support, means for passing a fluidising fluid through the support so that solid particles in the container may be maintained in a fluidised state, and second means for passing a fluid into the container from the same source as the fluidising fluid which means has a fluid outlet remote from the support, the arrangement being such that when the apparatus is in use, fluidised particles are transferred from the container through said conduit by fluid emanating from the outlet of the second means for passing a fluid into the container.

The second means for passing a fluid into the container may comprise a conduit passing through the fluid permeable support and terminating in the upper part of the fluidised bed. Solid particles may enter the container through a separate conduit. Alternatively, the particles may be passed into the container through the conduit through which the additional flow of fluid is passed to the fluidised bed.

Following is a description by way of example and with reference to the diagrammatic drawings, filed with the Provisional Specification which show in central vertical section two forms of apparatus, of two methods for carrying the invention into effect.

The apparatus shown in Figure 1 consists of a container 10, having a perforated support 11 for the solid particles, a conduit 12 through which solid particles are passed into the container, a conduit 13, fitted with a valve 14, a conduit 15 fitted with a valve 16, and a conduit 18 through which particles can pass from the container. Gas is supplied to the conduits 13 and 15 through a tube 17.

The method of controlling the transfer of

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solid particles from the container 10 is carried out as follows:— Solid particles pass through conduit 12 under gravity into the vessel 10 where they are formed into a fluidised bed by means of a gas stream flowing from the tube 17 into the conduit 13. The rate of flow of gas and hence the degree of fluidisation of the particles is controlled by means of the valve 14. Gas from the tube 17 passes through the conduit 15, the rate of flow being adjusted by means of the valve 16.

When fluidised particles rise above the exit of the conduit 15 they are carried from the bed into the conduit 18 by the gas stream issuing from conduit 15.

The transfer of particles from the bed may conveniently be controlled by adjusting the degree of fluidisation of the particles by means of the valve 14. By increasing the flow of gas through the conduit 13 more particles are made to travel above the exit of the conduit 15 and hence are available for transfer from the bed.

Referring to the alternative arrangement of apparatus shown in Figure 2, a container 20 is provided with a perforated support 21 for solid particles, a conduit 22, for passing gas and solid particles into the container 20, a conduit 23 for passing fluidising gas into the bed of solid particles and an exit conduit 24 for gas and solid particles.

The control of the transfer of particles from the container 20 through the exit conduit 24 is effected by control of the gas entering the fluidised bed with the particles through conduit 22.

The combination of flow of the gas stream used for fluidising the bed of solid particles and the gas stream entering through the conduit 22 is adjusted so that it is sufficient to transfer particles from the upper part of the fluidised bed through the conduit 24.

The method and apparatus of the present invention may be employed in a continuous process for contacting solid particles with gases or vapours such as described in our copending Application No. 33674/60 (Serial No. 951247).

#### WHAT WE CLAIM IS:—

1. A method for the controlled fluid transfer of solid particles which method comprises passing fluid upwardly through a mass of the solid particles to form the particles into a fluidised bed and providing additional flow of fluid to the upper part of the bed to transfer particles from the bed in an upward direction at a controlled rate.

2. A method as claimed in claim 1 wherein the additional flow of fluid enters the bed at a fixed height in the bed.

3. A method as claimed in claim 1 or

claim 2 wherein the fluid transfer of the particles is controlled by the rate of flow of the fluid which brings about the initial fluidisation of the particles.

4. A method as claimed in claim 1 or claim 2 or claim 3 wherein the fluid is a gas or a mixture of gases.

5. A method as claimed in any one of the preceding claims wherein the fluid for fluidising the particles and the fluid for transferring particles from the bed are derived from the same source.

6. A method for the controlled fluid transfer of solid particles substantially as hereinbefore described with reference to Figure 1 of the drawings, filed with the Provisional Specification.

7. A method for the controlled fluid transfer of solid particles substantially as hereinbefore described with reference to Figure 2 of the drawings, filed with the Provisional Specification.

8. Apparatus for the controlled fluid transfer of solid particles which comprises a container having a fluid-permeable support for the particles, the upper part of said container terminating in a conduit, means for passing solid particles into the container so that the particles are introduced into the container above the support, means for passing a fluidising fluid through the support so that solid particles in the container may be maintained in a fluidised state, and second means for passing a fluid into the container from the same source as the fluiding fluid which means has a fluid outlet remote from the support, the arrangement being such that when the apparatus is in use, fluidised particles are transferred from the container through said conduit by fluid emanating from the outlet of the second means for passing a fluid into the container.

9. Apparatus as claimed in claim 8 wherein said second means for passing a fluid into the container comprises a conduit passing through the fluid permeable support.

10. Apparatus for the controlled fluid transfer of solid particles substantially as hereinbefore described with reference to Figure 1 of the drawings, filed with the Provisional Specification.

11. Apparatus for the controlled fluid transfer of solid particles substantially as hereinbefore described with reference to Figure 2 of the drawings, filed with the Provisional Specification.

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